

SUPPLEMENT.

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FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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CANNOCK CHASE, AND ITS COAL MINES—No. IV. BY WILLIAM HOLYNEUX.

The abandonment of the Beaudesert Collieries appears to have been caused by their unsightly character in the midst of scenery so thoroughly sylvan and ancestral as that of the old park and surrounding grounds; but mining operations on the part of the Marquis of Anglesey were by no means closed with these old coal pits. The greater part of the material so used was taken to Brereton, and re-erected on some of the old shallow workings adjoining works established many years before by Lord Talbot. In 1854, these restored mines were leased to this nobleman, and in the same year the Marquis of Anglesey commenced the now well-known collieries of Cannock Chase, his lordship opening the works by driving the engine with the first tub of coal brought to bank. The original pits are now abandoned, and four others have been subsequently sunk by Messrs. M'Clean and Chawner, to whom Lord Anglesey leased the mines, and the Cannock Chase Colliery Company, into which the former firm is now merged, Mr. M'Clean being the chairman and principal director.

The coals worked at the Anglesey pits were the shallow and deep coals; and in addition the Gubbin ironstone. The great fault running from Dawend to North Staffordshire, already alluded to, passes within a short distance of these pits, and soon after they were started an unforeseen obstacle arose from coming upon a cross fault running nearly at right angles with the other, which let into the workings vast quantities of the loose bunter sand and pebbles with which the fault was filled. In this immediate locality, and extending parallel to the principal fault for the distance of a mile at least, occur numerous dislocations of the strata, some of which are of serious extent, and all adding more or less to the difficulty and expense of mining. In a westerly direction this displacement is not so conspicuous, headings having been driven for a considerable distance without meeting with more than ordinary fractures. It is also evident that over the entire field most of the lines of dislocation run parallel to the dip of the strata except in the case of the boundary faults, by which the coal beds are thrown into a series of troublesome positions, resembling on an enlarged scale a transverse succession of the precipitous locks of a canal. Between the two shafts of the Anglesey pits, a downthrow of 20 yards places the shallow coal on a level with the deep coal; at the succeeding pits the beds have sustained a further subsidence of 60 yards, and at the following works they have returned to their normal position. These beds all rise to the eastern fault, where they abut on a white sandstone rock free from pebbles, the topmost bed being within 60 yards of the surface. Their inclination averages 1 in 16; but they show a somewhat variable dip, ranging on the south side of the cross fault about west, and on the north side of it from north-west to north-north-west.

Three coals are now worked at these collieries, the Bass, the Shallow, and the Deep coals. Six feet below the latter a mass of clod contains numerous curious nodules of ironstone, not unlike in some instances those of the Penny stone; and below these is the Gubbin ironstone, 6 in. thick, irregularly bedded, and showing a disposition to thin out. Both of these stones are worked to some trifling extent, but they are too poor for any special purpose. Following the line of the great fault to the Noddy field valley the coal measures are overlaid by a thick deposit of yellow clays and pebbles; and in a brick yard close to one of the roads recently made a bed of coal 9 in. thick comes out within a few feet of the surface. This is followed by light clays of about 18 feet, succeeded by a band of ironstone 2 or 3 inches, and a bed of coal 18 inches in thickness. These lie quite horizontal, and the uppermost bed can be traced up the side of the hill west, where it is, however, in one section thrown into every conceivable form of contortion and curvature, and dips slightly to the west. On passing over the hill to the succeeding valley, near Cockayne's lodge, the coal measures are capped by an outlier of the Bunter conglomerates, of a most remarkable and interesting character. It has been quarried for road purposes, and the excavation exposes a section of 10 ft., from the base of which issues a spring of excellent water. Fragments of this rock, easily detected by their highly ferruginous appearance, may be traced for some distance in every direction, the smaller pieces being the more widely distributed, but showing little of aqueous action. Below this are numerous mounds, indicating by their frequency both pit and open works of an extended period.

About 20 years ago some miners sunk three pits on the flank of the hill, in Noddy field, but without meeting with the success they expected. They found that there remained for them the pillars only of a seam of coal, 7 ft. thick, former miners having anticipated them by probably some hundreds of years; and after working at the pillars about two years, the undertaking was abandoned. These pits were only from 23 to 25 yards deep, but the horizontal character of the strata elsewhere here gives place to an inclination of about one in five or six. This can be seen at the base of the hill near the Hew Hayes, where the coal crops out, and following this hill on towards Hednesford the same bed of coal may be traced from the point of its dislocation in the Radmore Wood for a considerable distance. It is a fair coal, and when worked had a ready sale, but it is by no means an excellent one.

On the opposite or northern side of the valley a bed of shale and impure coal sets in dipping north-north-west. It is about 2 feet thick, and a little distance from the outcrop, as proved by workings, becomes very good fuel. The dip of this bed is interesting, and indicates the existence of a fault by which the various beds of the opposite side of the valley have been brought in. Still going north-west, the Castle Hill is reached, and on its northern face is exposed the Nine-foot coal, already alluded to as Riley's Mine. From a careful examination of this and other beds of the field, I am strongly inclined to the opinion that it is identical with the seam formerly worked in Noddy field, although there but 7 feet thick, and consequently an extension of the Seven-foot coal of Hednesford, and probably the Wyrly Bottom, or Eight-foot coal, of Bentley.

If we take a section due south from Brereton Hayes, across Castle Hill to Noddy field, we shall get a tolerably accurate notion of the position and stratigraphical arrangement of the various coal seams and measures of which this area is composed. At Brereton there are fifteen seams of coal, the lowest of which is found at about 556 feet from the surface. These beds have numerical names, according to the order in which they occur, and they constitute an aggregate thickness of 49 ft. 7 in. Beyond the pits, in the direction of Rugeley, some of the upper beds crop out. From them to the workable beds we find the dip to be east-south-east at about 1 in 35, occasionally accelerated to 10 in 35. Over the Brereton Hayes this position is maintained, and on reaching the Old Park the Haxley ridge of Bunter beds sweep round and overlie the coal measure clays, stretching

down, however, towards the valley, which separates them from the Castle Hill. At Brown Hills, the southern limit of the district under notice, there are 21 beds of coal, the uppermost of which is 2 ft. thick, and the lowest Bottom or Deep coal 6 ft. 8 in., which occur at a depth of 916 ft. On comparison, the sections of these different workings show great dissimilarity, but, notwithstanding this, there is no doubt of their individual identity as members of the same important group.

ROYAL CORNWALL POLYTECHNIC SOCIETY.

The present year's meeting of this society has, without doubt, been one of the most successful that has ever been held. In addition to the advantages attributable to improved means of intercommunication, certain trifling modifications have been introduced in the society's standing orders, which could not fail to attract an increased number of exhibitors and competitors for prizes, and, at the same time, to keep the position of the association equal to that of the most liberal of its rivals. The department of the exhibition of more special interest to the readers of the *Mining Journal* is, of course, the mechanical, which has this year fully doubled in extent. There is a variety of articles and models of great merit. There is one of Moshier's patent percussion tables for ore dressing, an invention of considerable importance; Dawbarn's hose clamps; Warden's V-shaped pumps, one of which is to be seen at work. It is capable of throwing up 1000 gallons of water in an hour, being applicable for either forcing or lifting. A very neat working model of the turbine-wheel, which draws its water from a handsome fountain, plays in the centre of the room, and works away continually, is an object of great interest. There is a beautiful model of Sedley's patent bridge for crossing rivers and valleys at one span, at any height or any width, up to 1500 ft., without the aid of intermediate piers or other supports. The bridge is a combination of the tubular, girder, and suspension principles, and combines great simplicity—"the supreme excellence" of mechanics—with easy and economical construction. Wood, iron, and steel may be used in combination. No subaqueous works are necessary. The bridge is said to be capable of being built with as great ease at 500 ft. above the river as at 25. The model is light and graceful in appearance, and the bridge, which was scientifically tested for strength at the International Exhibition, is capable of wonderful resistance. It is a system particularly suited to the present requirements of Falmouth. A bridge on this plan, connecting Falmouth with Flishing and the slopes looking towards the harbour on Lord Clinton's estate, would be of immense advantage to a rising town, desirous of possessing beautifully situated and salubrious suburban villas. There are specimens of Wright's diagonal steam-bolter, by which a gain of 40 per cent. in strength is said to be secured. Husband's patent safety balance-valve; Gaultier's pyrometer, for measuring heat at high temperatures; marine steam-gauges; Gore's gas furnace for assaying purposes; gas stoves; and Wyzell's double-acting ventilators for carriage windows, a very ingenious invention. Tansy and Co., of Birmingham, exhibit a portable hydraulic pump, which attracted considerable attention from scientific men. The pumps are made of various sizes, and are capable of applying any required power either by hand or steam. One shown is only 14 in. long in the body; it is placed on legs, which are attached for shop purposes. It is capable of applying a pressure of 25 tons, punching conical holes through half-inch iron plates with but little effort on the part of the workman. The body is made of wrought-iron. It is of cylindrical shape. In the upper part of the cylinder is fixed the reservoir, and the force-beam is screwed into the reservoir. The lever and plunger are enclosed in the cylinder, and connected by a shaft coming up through the box, on one side of which is the hand lever. The lever gives a certain length of stroke for working the press, and when the hole is forced through the lever gives an extended stroke, so as to open the valves, and then a powerful lever is applied, giving a return stroke pressing the water through the pump into a cistern again, and turning the punch out of the iron plate. This little machine, with a quart or a pint of water, will yield a pressure of 25 tons, and will punch a three-quarter hole through a half-inch plate. It performed its work very cleanly, and received much attention from scientific and practical men, and the judges awarded to it the second silver medal. There is also a very compact little hydraulic lifting-jack, exhibited by the same firm. It works upon exactly the same principle as the pump, and is capable of lifting from 4 to 60 tons, worked by one man. Amongst the other objects of ingenuity are Higgin's exploring lamp; Brunel's system of breakwaters; models and plans for ventilating mines; designs for steam-boilers, &c. Mr. John Jewell, of Basset Foundry, Devon, is suggesting a means of ventilating mines, goes upon the principle that if foul air is removed, the pure air will find its way in as a matter of course, and that the good air is kept out by the presence of the foul. His proposition, therefore, is to introduce a cylinder into every shaft or place where good air is required, which cylinder is a pump, to be worked by the ordinary engine of the mine, and by means of this pump to withdraw and discharge the foul air, when, upon his theory, the light pure air will find its way into the place from where the heavy and impure air has been ejected, and supply the wants of the workmen in the shafts or other parts of the mine operated upon. Mr. W. Oke, a schoolmaster of Illogan, goes upon a different principle, considering it necessary to supply the good air as well as to withdraw the bad. He showed a model of his plan, in which he takes two square tubes, or pipes, from the surface down the shaft of the mine to a portion of the works requiring ventilation. Each of the tubes is supplied with pumping apparatus, to be worked by the engine of the mine or by other power. One of these withdraws the bad air, and the other, at the same time and in the same ratio, carries down the good air. In order to convey the pure air to various parts of the mine, an air carrier is constructed. It is a square wooden frame, covered with air-tight cloth. This, when filled from the pipe running down from the surface, is to be conveyed by hand, or in any other way, to the place where it is wanted. This invention is said to be in use in one of the mines at Illogan, and to be working remarkably well. Mr. Jewell, of Basset Foundry, Devon, in addition to the scheme for ventilation above noticed, exhibited a model of a pair of steam-boilers, for which he claims great merit, particularly in respect to economy of fuel, and it is of great importance to those connected with mining. The boiler is patented, and is called a fine and tank boiler. The model is of two boilers, with wrought-iron flues, for conveying the fire entirely over the surface of the boiler below the water-line, and doing away with the line coming in contact with the boilers at any part, line having been found to be destructive to boiler-plates. Between the boiler is a wrought-iron tank, extending the whole length of the boilers. It contains the water for feeding the boilers, which can be made to pass into the boiler at any temperature required. There is an arrangement for cleaning flues without a man passing through them, and they may be cleaned while hot. This plan answers for any size or length of boiler, and does away with cold water feeding. The waste steam is conveyed into the cistern. The flues for a 6-ft. boiler will be 1 ft. by 1 ft. Boilers on this plan are in operation at the Basset Foundry, where those interested may inspect them. The water in one of these boilers, 5 ft. 2 in. by 6 ft. 2 in. in diameter, with 15-in. tubes, with 18 lbs. of coal, was made to boil, and kept at working temperature for one hour. The same amount of coal used for the same sized boiler on the old plan—set in brickwork—only brought the water up to 182°. This is a saving in fuel of a little over one-third in favour of Mr. Jewell's invention. George Rowe, one of the workmen in the Basset Foundry, shows an excellent and exceedingly simple apparatus for striking centre-lines on roads, which is, with hot iron, frequently a difficult matter. By this plan it is rendered easy, and the lines must be true, if properly worked. There is a V-shaped trough, the edges of which are parallel lines. In this the rod to be marked for slotting is placed. The position of the line required being settled, a diamond-shaped point is fixed by a slide and screw, and the plane upon which the screw is adjusted is worked against the fair surface of the side of the trough, so that the point impinging on the rod makes the required line. This process, though difficult to explain clearly, is very simple. Thomas Eddy, of Redruth, shows an improved capstan for mining purposes, either for steam or horse power. His peculiarity is that, no matter what weight it may be lifting, it can never slip; it is worked with a screw and cog-wheel. Mr. Eddy has been honoured with a first bronze medal. Mr. W. Sara, of Penryn, exhibits a direct-action steam stamping-mill, in which the steam comes directly out of the piston, and lifts the weights without the aid of complicated machinery. There are three of four working models of engines, and a model by Mr. O. L. Treganza, of Truro, of a plan for preventing engines from running off the line, and another to compel them to return after they had run off. A very interesting model is that shown by Messrs. Sharp and Co., the contractors for the Falmouth line. It is an illustration of the plan invented and acted upon by them in the construction of the viaducts which they so successfully erected. The process is novel and ingenious, and the model so arranged as to show how one part of the viaduct is used in constructing another.

The Fine Art Department, which to the general visitor is, perhaps, more attractive than any, embraces a display superior to that of any former year. There is more than an average number of pictures by old masters, many of them of rare excellence, contributed by gentlemen in Cornwall and the adjoining county; while, as regards the work of professional artists and amateurs—the most important portion of the exhibition—they afforded unmistakable evidence that decided and very satisfactory progress has been made since the last exhibition. There are 14 departments or sections recognised by the society, and the business of the meeting may be considered to have commenced with the reading of the reports of the several committees. In his introductory address the Chairman, Mr. J. J. Rogers, M.P. (who was supported by Mr. Richard Davey, M.P., Mr. Augustus Smith, M.P., Venerable Chancellor Phillips, and a large number of the county gentry), observed that they met under very favourable auspices this year, their exhibition being especially benefited and encouraged by the recent introduction of railway communication to Falmouth, which puts them in correspondence with the rest of the civilised world; and they hoped that this communication, which had brought them a greater number of visitors on this occasion, would in future years add to their exhibitions a greater number and variety of novelties. We subjoin a list of the principal awards connected with the subjects in which our readers are interested.

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FIRST SILVER MEDAL.—Mr. NICHOLAS SARA for direct acting steam-stamps, showing a method of applying steam power for the purpose of lifting stamps used in crushing the ores. The application of steam in this manner has claimed the special attention of Mr. Charles Fox, and that gentleman has offered a premium for inventions of this description; but, as this is the only machine exhibited, the society has awarded its highest prize, the first silver medal, to Mr. Sara. Mr. Fox's prize has not been awarded. —SIR WILLIAM ARMSTRONG for his hydraulic engine.

SECOND SILVER MEDAL.—Mr. HUSBAND for a safety balance-valve, the object of which is to obviate the necessity of erecting pipes of great altitude in order to obtain a high pressure of water. It was formerly the practice in the construction of water-works to erect very high pipes on a tower, and the engine pumped the water to the top. In this invention, however, a heavy weight is substituted for the column of water, and by this means a very large saving in cost is effected. —Mr. WAST, of Hayle Foundry, for a patent air-pump, hydraulic valves. The valve consists of a spiral coil of mechanised India rubber, readily capable of adjustment, and not easily put out of order. In the opinion of the committee it is a very decided improvement upon a somewhat similar valve hitherto in use, consisting of a series of rings of India rubber. —Messrs. TANGEY and Co., of Birmingham, for a portable hydraulic punching bear, an eminently useful invention, which, although very compact and portable, is of so great power, that with the very moderate exertion of a single man a plate of iron half or three-quarters of an inch thick may be perforated in a few moments; an operation which, when performed by the machines ordinarily in use, requires a very much larger amount of labour, and occupies a much longer time.

FIRST BRONZE MEDAL.—Mr. J. MOSHEIMER for a model of Mr. P. Rittiger's continually discharging percussion table, for slime dressing. It has been for some time at the mining works at Dolgelly, in North Wales, but it is believed has not been hitherto used in the manipulation of ores produced in the county of Cornwall. The committee consider the invention as well deserving of trial in this county, and think its use may be attended with advantage. —Mr. EDDY for the model of improved mine capstan. This model is the production of two workmen, and displays some ingenuity in the application of the principles of the screw; and considering that it was constructed by two working miners, the society has awarded a first bronze medal, or 3*l.*, at their option. —Mr. GAMBLE's salinometer, for measuring the amount of salt which is contained in a ship's boiler or other vessel. It is attached to the boiler, and indicates the proportion of salt which is held in the solution, enabling the engineer readily to ascertain when his boiler requires cleaning. —Mr. HUSBAND for his patent pump-valve, in use where the pressure of water on the valve is very considerable, and is, to some extent, a modification of a valve hitherto in use. The committee consider the invention decidedly meritorious. —Mr. WYSE for his double-acting ventilators for railway and other carriages. An ingenious contrivance for supplying a want very much felt by everyone riding in carriages, and for the avoidance of quarrels as to whether the window shall be up or down. The motion of the carriage causes the air to pass through a tube fixed on the outside of the door, or other convenient part of the carriage, and the quantity may be regulated by a valve in the interior of the carriage.

SECOND BRONZE MEDAL.—Mr. DAWBARN for his patent hose. Clamps of flexible tubes is a contrivance for readily and effectually stopping rents or imperfections in tubes used for conveying water. Such are attached to fire engines and other machines. It consists of two elongated discs of brass or other metal, connected in the centre by a screw, one of the discs being interspersed throughout the rent into the pipe, the other is then screwed up to it so as to close the orifice. —Mr. A. SENTER for his patent equilibrium chair, which has already been described in the *Mining Journal*. A second bronze medal was also awarded for a small working model of the steam-engine, to illustrate the application of a new parallel motion, which appears to be well adapted to engines of a small power, and displays considerable ingenuity.

MONEY PRIZES were awarded for a working model of a turbine, very creditably executed by an amateur—1*l.*; for the model of the method of constructing the viaducts on the Cornwall Railway, by a workman—2*l.*; and for a model of railway points by a workman, 10*s.*

HONOURABLE MENTION was awarded to Mr. W. SARA for a crusher for tin ores. This is an adaptation for crushing of tin ores by machine already in use for grinding mortar and other substances. A pan on which the ore is to be placed is made to revolve under two heavy rollers, with the substance as crushed. The judges highly recommend this machine as well worthy of trial, and had it been proved to answer its intended purpose, its ingenuity would have rendered it worthy of a prize.

MINERS' ASSOCIATION OF CORNWALL AND DEVON.

The annual meeting of the Miners' Association was held in the Council Chamber of the Polytechnic Hall, Mr. ROGERS, M.P. for Helston, in the chair. Before the actual business of the Association a paper "On the French Corps of Mining Engineers," by Mr. BURNELL, was read. The author gave some very valuable facts relating to the French Mining System, which he stated was founded on the principle of the right of the State to the minerals found underground. The working of mines was subject to the superintendence of a "Conseil des Mines" which was composed of inspectors-general of mines of the first, second, and third classes, and had a president when the Minister of Public Works did not attend. For the execution of its directions the service was organised into three departments—the "service ordinaire," the "service extraordinaire," and the "service detache." The latter attended to mines worked for the benefit of the State in Algeria and the colonies; the ordinary service was for the permanent works, and was subdivided into districts; while the extraordinary service searched districts in which mines had not yet been worked, and suggested the measures to be taken for their working with the greatest profit. An inspector-general, resident in Paris, and the engineers ordinary, were bound to inspect the mines personally. It was necessary for the engineers to receive a thorough education, and their studies extended over several years, and they had then to pass a very severe examination before they were qualified to enter the service. But promotion took place according to seniority, and no degree of talent would entitle the possessor to preference. The "Ingénieur des Mines" was entitled to prescribe for the working of mines any regulations which he thought necessary, and he advised the Government as to the propriety of granting permission for the working of mines, and to the indemnity to be given in certain cases. The workers of mines had several duties to pay, one being a rent to the State for the privilege of working. An important duty of the engineers ordinary was the collection and preservation of the plans of old workings, and the statistics of mines. There were made use of by the Government officials to check the progress of mines from time to time, and enabled calculation as to future progress to be made. The Government watched assiduously over the miners, and insisted upon all possible measures being taken to preserve them from accident. Mr. Burnell observed that the tendency of the French system of government was to depress the national intelligence, and the result of the French mining system was to check the spirit of venture. He was of opinion the French system was founded on a wrong assumption, and led to a false state of affairs, by depriving the surface landlord of his rights, which could never be interfered with with safety to the interests of the community. Mr. Burnell added that the number of French miners was actually less now than before the introduction of the present system, and they were about one-fifth the number of English miners.

The Chairman expressed the thanks of the meeting for Mr. Burnell's valuable paper. He should be sorry to exchange systems with French miners. The old principle of the English law—the feudal system—was that the soil and the minerals below it were the property of the Crown, and that only when it abandoned this right they became the property of individuals.

Capt. SULLIVAN, R.N., said the Government had exercised this right in the colonies since the gold discoveries, and particularly in Australia.

Mr. TULLY believed such a system of mining as that of France would be more destructive in England than in that country, for our people were impatient of anything like paternal authority that they would throw up their mines in disgust. It

was satisfied, from information he had long possessed, that French mining, with such a system as the present, would continue to dwindle. It was now kept up by English capital and superintendence. There was a great deal of truth in the saying that a mine agent could not be made by education, but must be born one.

After some observations from Mr. Grylls, the meeting resolved itself into the regular reunion of the Miners' Association. The CHAIRMAN having opened the proceedings with a brief speech, in the course of which he referred to the programme of the business of the present meeting as one of real substantial work, which would be very satisfactory to all who were interested in the important proceedings of the Association.

Mr. ROBERT HUNT, F.R.S., Keeper of Mining Records, and hon. secretary to the Association, stated that he had received letters, regretting their inability to attend, from Mr. Bassett (the President), Mr. Kendall, M.P., and Mr. St. Aubyn, M.P.

Mr. PEABODY and Mr. TWITTE, the teachers of the Association, next gave some particulars respecting the classes under their care, and the very satisfactory progress made by the pupils. They referred to the establishment of field classes, and the latter produced some highly creditable plans made by members of the class at Helston, from their own survey. The CHAIRMAN then called upon

Mr. HUNT, who delivered a lengthy and interesting address. He said that when, a few years since, the Miners' Association was contemplated, it was remarked very generally by those from whom they had expected support, that there would not be a sufficient amount of interest shown by the working classes in the mines of Cornwall to warrant the carrying out of the intention. Several gentlemen in the county had then stated to him that they were perfectly satisfied the experiment would be a failure; and that, at all events, they would not subscribe until they saw the stamp of success upon it. He was now, however, in a situation to state, on the authority of an Inspector recently sent down by the Department of Science and Art to examine into what the Association had been doing, that, so far from its being a failure, it had been a most decided success; for it had been shown most convincingly that there existed a strong desire among the young miners of Cornwall to avail themselves of the scientific instruction brought within their reach. He held in his hand the 10th report of the Department of Science and Art, from which it appeared as follows:—In the class of the Association at Gunnis Lake there were 24 under instruction in mechanics and mineralogy; from Camborne there were 21, and from Helston 19; and there had been a class of 6 learners in mechanics, chemistry, and mineralogy; Helston had a class of 27, the subjects of instruction being mineralogy and mechanics; Crowan 23, mineralogy and mechanics; the Lostwithiel class in abeyance, but last year there had been 20 under instruction in chemistry and mineralogy; Marazion 10, mineralogy; Redruth 20, mineralogy and mechanics; last year 33 were being instructed in chemistry, mineralogy, and mechanical physics, and the students of that town had gained seven Queen's prizes; St. Agnes 12, mineralogy; last year 17, in chemistry, mineralogy, and mechanical physics; St. Blazey 10, mechanics; St. Day 15, mineralogy; St. Ives 10, mechanics; St. Just 16, mechanics and mineralogy; last year 24, in chemistry, mineralogy, and mechanical physics; Tavistock 12, mineralogy and mechanics; at Tywardreath, last year 14 studying chemistry and mineralogy. This made a total of 178 students at present under instruction in the classes of the Association, above 150 of whom were working miners—men actually working underground—while the remainder were closely connected with mining operations, though not, perhaps, coming strictly under the former head. But that the funds of the Association were limited, its operations would be considerably extended; several places in Cornwall and Devon being most desirous of having classes organized among them. He had had applications of this description from Bude, Looe, and Chum, but at present it was not possible that teachers could visit those towns. It was an object with the Association to obtain the assistance of those miners who had received a superior education, and to establish classes for mutual instruction; and Mr. Hunt referred to instances in which these results had been obtained. He thought it would be admitted by all, when it was considered that the income of the Association had never exceeded 300l., and that their lecturers had to travel over the district from Tavistock to St. Just, that a very great deal had been done in bringing under instruction nearly 200 young miners. In addition to their systematic teaching, their lecturers had also given short lectures on the various subjects of science, and had attended to the numbers not embraced in the numerical statements he had given. These courses of lectures were proposed to extend, so as to bring the advantages of scientific knowledge more directly before those who were not acquainted with the value it would be to them. If this were done, they knew by experience that they would be called upon to establish new classes; but they would not be able to establish them unless their income was largely increased. Even at present their working expenses exceeded the subscriptions they received, and consequently, unless they got general support they could not go on with that ease and energy with which the work had been carried out in the past year. The Association had met by the railway, and the lecturers had been enabled to do so, which, at a very large reduction from the usual amount of charges, had furnished tickets for the use of the lecturers when travelling upon the business of the Association. This had been a most material aid, and without it they would not have been able to do what they had. The travelling expenses beyond railways were, however, very large, and it had required the exercise of almost a parsimonious economy on the part of the committee to carry out so large an amount of work for so small an amount of money. Many gentlemen in the county had expressed themselves disposed when they saw the stamp of success on the work to give it their support; and as they had never over the first difficulties, and had shown that a desire existed among the young miners to acquire knowledge, he did hope these gentlemen would add to its funds. They all knew that with the increasing depth of their mines increasing difficulties must be encountered, which could only be met by calling in all the aids of knowledge. There had been many very great mistakes, however, made by people as to the value of science to the working miner. He had been asked by men of common sense upon ordinary matters, what was the use of the knowledge of chemistry and of other branches of science to the working man? The value in the young miners of the branches of science in which the Association desired to see them instructed was just this. They would be enabled thereby to handle their tools with more dexterity—to save their muscle and material powers by taxing to a small extent the mind. The object of the field classes was to tutor the students in habits of observation. Those habits were very important; persons without them would travel along a road and see nothing worthy of notice; whereas a man who had them would find the path strewn with treasures, which would be of use to him and mankind. Thus the great value of the training of the Association to the Cornish miners would be in teaching the young men the observation of things which were immediately under their eyes. The chemistry taught by Mr. Peabody would prevent those who learned it from committing the great mistakes in mining matters which were frequently made, one or two instances of which he might mention. The workers of some copper mines in the Argentine Republic had been for a long series of years in the habit of throwing away very large quantities of iron ore, or gossan, which it had recently been discovered contained silver, in a proportion varying with the different samples from 316 ozs. to the ton to nearly 2000 ozs. Had the workers of that mine possessed the slightest knowledge of the principles which Mr. Peabody had admirably brought before his classes, such a waste could never have been committed. It was not long since, also, that a young Cornishman had sent him (Mr. Hunt) a lump of what the miner believed to be lead; but which turned out to be chloride of silver, the piece being worth 37, or 41. The slightest application of the blowpipe would at once have revealed the true character of the substance. A considerable quantity of this ore had since been raised in the district whence the piece came. The interest felt by the young men in the operations of the society, so far as they had gone, was remarkable. A week or two since, he had visited the class at St. Day, where he found the greatest interest taken in mechanical and mineralogical teaching. The chemistry taught by Mr. Peabody was so simple, and the most perfect system and the simplest method of making a survey, and avoiding errors, would be of great advantage. There were many mines in Cornwall which he was compelled to say, speaking with complete independence, were worked with an imperfect knowledge of mechanics, and upon an imperfect system of engineering. An enormous quantity of power was lost for want of proper attention to that which stood in opposition to motion, friction, wasting a large amount of force, which might be more economically employed. It was to these matters that they particularly wished to direct the attention of young miners. He was perfectly satisfied that in doing so the Association was performing a great and good service, and that it was to the credit of the young men interested in mining to assist in its operations. He had heard it stated lately by a gentleman of high standing in the county that he believed Cornish mining prospered upon the ignorance of the multitude. He regretted to hear such a statement, which he was satisfied was made in error. The greatest injury to Cornish mining was that which arose from ignorance; and if they could only imbue the minds of their young miners with some knowledge of chemistry and mineralogy, practical mechanics and geology, great good would be effected. Their mines would be worked with more certainty and less risk to human life and property, and by which to render the occupation of the miner more salubrious than it at present was. Cornwall would be advanced in every way as a mining county by the dissemination of knowledge in the branches of science to which he had especially alluded. Up to the present time the officers and members of the Miners' Association had been fighting an up-hill game. They had been contending with prejudices of various kinds, which were slowly but surely dying out; and if they could only work on—work and wait, he believed, must be their motto—he felt convinced that all the prejudices in their path would die out, and that they would get the support which they deserved to carry on the operations of a society which they cordially believed to be for good.

The reading of the papers, &c., which were in most cases followed by a brief discussion, was then proceeded with. Mr. C. Fox, the Vice-President of the Association, opened the question of the very injurious effect upon the miner of the severe exertion of driving holes for blasting under the present system; and the possibility of the prevention of the disease thus caused, and at the same time expediting the work by the prevention of some other means. He remarked that from statistics which had been kindly furnished him, he had ascertained that about 6000 men were driven in Dolcoath Mine, about 4500 in St. Ives, and about 3900 in Carn Brea every two months. He had only been able to ascertain the number of fathoms driven in the same period in Carn Brea, which was 83, given an average of about 50 holes per fathom. What muscular effort must have been expended in carrying out this work, under the very unfavourable circumstances with which it was attended! Mr. Fox then stated that during a recent visit to the Continent he had inspected the boring machine (which he described) employed in driving the great tunnel through Mount Cenis, the operations of which were most satisfactory and effective, the tunnel progressing through hard rock more than a fathom per day. The machine was driven by compressed air; and he saw no reason why the same principle might not be applied to the driving of their mines. It was a most important matter, not only as regarded the health of the men, but to everyone interested in mining, for the advantages that would accrue if the work could be done with greater speed (which such a machine he believed would effect), must be apparent to all. In his concluding remarks, Mr. Fox mentioned with approbation Capt. Hunt's jiggling-machine, which had extracted 12 grains of gold—the whole quantity the stuff contained—from a ton of sand brought from Van Diemen's Land. Mr. Fox made some remarks in explanation of a boring machine he had seen in operation in Wales, somewhat on the same principle as that at Mount Cenis, which, although at present worked by steam, might like it be driven by compressed air. This machine, which had been alluded to by Mr. Fox, was made by Mr. Crease, and improved by Mr. Green, of Aberystwyth. After each stroke of the borer, it is turned a quarter round, as in hand-boring, and a screw presses the borer forward as the hole deepens. Holes can be driven with it in any direction, and five times as rapidly as by manual labour. Drawings, &c., illustrative of each machine, were produced, both by Mr. Fox and Mr. Twitte. Mr. Fox next read a paper on the nature of some interesting mineral deposits in Galloway. Near the town of Ferrol, at the extreme north of Spain, the clay-slate covered a large tract of ground. It appeared to resemble in a very striking manner the clay-slate of Cornwall. In many cases it was charged with small detached crystals of iron pyrites, and where the slate had been subjected to an elevating force beds of this mineral were found from 4 in. to 2 ft. in thickness. Three beds of this ore had been wrought in several places in the district, under the direction of Mr. Barrett, a Cornishman. The Victoria Mine, situated in one of these bedded deposits, had been at work for some years, and had yielded a profit to the proprietors. The ore consisted of very compact iron pyrites, containing variable quantities of copper, ranging from 2 to 8 per cent., with 35 to 45 per cent. of sulphur. The ore was shipped to Liverpool, where the sulphur was converted into sulphuric acid, and the copper concentrated into the form of a regulus, and then sold to copper-workers in Swansea. The paper concluded with a detailed description of the beds of ore.

Three papers were then read by Mr. Hunt, which had been written by members of the Helston class, a circumstance to which that gentleman referred with considerable pleasure. The first was upon the very important subject of steam-blower explosions. The writer expressed a belief that the tube-gauges, by which it was sought to be ascertained what water was in the boilers, were improperly placed, and that they ought to be at the hottest parts. He referred to the fact that many of the persons employed to look after steam-boilers, who had been seriously injured by their explosion as to life, it had been stated that just before the explosion they had found that water would come from the tubes. He believed that this was true, and that water would often be found to run from tubes as at present placed, when the hottest portion of the boiler contained none. Mr. Hunt said this was a most important subject, and asked the attention of mine engineers to it. He alluded to an experiment which bore out the principle contended for:—If an upright cylindrical vessel were taken, having three holes bored in it, and was filled with water until it ran out of the second hole, then if a strong degree of heat were applied, the water would run out of the top hole, but not out of the lowest one, the bottom of the vessel being occupied by steam in the spherical state.—The next paper read by Mr. Hunt was "On surface indications of Mineral Deposits." The writer, after remarking that certain conditions of the surface are connected with the occurrence of rich mineral deposits has long been held by miners in Cornwall, observed:—"The most striking peculiarity of the Cornish mining district is the undulating character of the surface. Valleys of peculiar shape and formation follow it in every direction. The ridges bounding them may be assumed to mark the position of certain forces that have enabled the rocks at those places to resist the denuding action in a greater degree than in others, and it is when running parallel to such ridges that veins become productive. In these positions the cleavage planes are parallel to the ridges, and, therefore, to the ridges, a condition which favours the accumulation of a rich bunch of ore. The position of the top of the 'chimneys' of the bunches are indicated by minor branches from the main trunk valley of the particular district, and three minor branches will rarely fail to be associated with a cross-course alide, hard bar of ground, or other variation from the containing rock, an evident change in the character of the adjacent country being as apparent as the mark upon the surface." It is not presumed that an infallible rule is to be laid down. The last paper read was by Mr. Macaulay Pallett, who described the present condition and mode of working of certain gold mines in Bolivia.

There were two other papers to be read, but it being near the time fixed for the trial of the patent blasting powder, the meeting separated, the thanks being given to the Chairman and Mr. Hunt, which were duly acknowledged.

THE PATENT SAFETY BLASTING POWDER.—At half-past 4 o'clock a large number of gentlemen, and also several ladies, assembled on a portion of the grounds of the Dock Company, in which extensive excavations are being made for the purpose of witnessing some experiments with the powder patented by the Safety Blasting Powder Company, of Devonport. The qualities of the powder have already been described, but its chief recommendation is said to be safety and cheapness. Mr. Kellow, the inventor, Mr. Davey, the general manager of the company, and Mr. Cornack, the local agent, were present. Two experiments were made, the ground in which the holes for the purpose were bored being of a rocky nature. The holes in the first experiment were 6 ft. in depth, and 6 in. in diameter, and placed 3 ft. apart, and the powder was 3 ft. 6 in. in depth, and in the second hole was placed 4½ lbs. of ordinary powder, of a depth of 3 ft. 5 in. Thus the two charges were not equal in quantity, and it was alleged that the ground surrounding the two holes was not of the same consistency. On the exploding taking place, the old powder had moved a good burden and thrown the pieces some distance, while the patent powder had only shaken its burden, without sending it so far as the other. A second trial was then made in a very large cutting, each charge in this case measuring 1 ft. 8 in. The ground was heavy, and each charge had a good burden put before it. Both did their work well.

INSPECTION OF COAL MINES—INSPECTORS' REPORTS.

NORTH STAFFORDSHIRE, CHESHIRE, AND SHROPSHIRE DISTRICT.—Mr. WYNNIE, in his report for last year, regrets an increase in the number of accidents in his district. The cause of this increase may be traced, in some measure, to the want of that constant, careful supervision which can alone enforce discipline and ensure the proper carrying out of the general and special rules, upon the strict observance of which the safety of the miner so materially depends. It is to him a matter of regret that several of the largest proprietors in his district, instead of increasing their staff, are dispensing with the services of managers altogether, and many have placed their collieries under the care of underlookers,—very good men in their sphere of usefulness, but totally unfit to control the actions of large bodies of men, or to act with promptitude under the trying circumstances which mining constantly gives rise to. Now, this would not be the case if the large proprietors could themselves see that they were going on below ground, or hear the underlookers, but at being so little cared for that the services of a competent manager are too expensive to be retained. In his opinion, a good resident manager is an absolute necessity at every colliery of magnitude, and, taking the narrowest view of the subject, will repay the cost of such services. With respect to accidents from falls of roof and coal, he states that he has to make grave complaints of want of care and attention on the part of the underlookers, for out of 25 accidents 14, under ordinary care, would have been prevented; for had the rule which provides that timber shall be set every 6 feet being carried out, most of these poor fellows would have been now alive. He observes that although the Shropshire code of special rules provides that not more than eight men and boys shall descend any pit at one time, it was proved at the inquest that it was the regular practice at this pit to let down twelve men at a time, and on the morning in question the chartermaster himself assisted in sending down one lot of twelve men and boys before the accident occurred. It was also proved that he was in the habit of urging others to get into the cage when more than the proper number were already in it. Mr. Wynnie has since instituted proceedings against the banker, when he was ordered to pay 100l. damages, and the banker has since been ordered to pay 100l. damages, with hard labour. It was perfectly clear, had he done his duty at least four lives would have been saved, and he much regretted that the chartermaster was not made to accompany him, for morally, if not legally, his crime was greater than the banker's. It is the more to be regretted, because this is the same chartermaster who, two years ago, met the men coming out of the pit, because the doggy had pronounced it unsafe, and forced them back again to their work. The result was that in a few hours there was an explosion; but as dismissal does not follow conduct so gross as this, it is not to be wondered at that in the morning, after cessation of work (as it is called), the chartermaster would arise from the increase of inclined planes, unless care and caution were used by the persons employed on and near them, and by those having charge of the roads and inclines underground, and he had now to report five deaths on inclines and two by trams and tubs on wagon-roads. As general precautions for securing safety, Mr. Wynnie recommends, as the results of his experience—1. That a well-constructed furnace should be in constant use at the bottom of every upcast shaft.—2. A more general and systematic use of brattice cloth.—3. That any neglect by the person appointed to examine the working places in the morning, or after cessation of work (as it is called), should be visited with instant dismissal.—4. That the return air courses should be enlarged, and more attention paid to the cleansing of them.—5. That so soon as the coals are got down the roof should be propped, and not left until the loader has done his work or, perhaps, been killed.—6. That the use of sprags should be enforced, whether required or not, as it is unseen danger that causes the loss of life.—7. That all timber should be removed from the roads when it becomes bent or broken, as it is likely to be caught in passing, and bring down other timber with it on to the head of the drive.—8. That a real and not a nominal and uncertain examination (as is too often the case) of the winding machinery by competent persons should be made at stated periods.—9. The general adoption of guides, and the consequent contraction of the pit top, whereby great damage to the walling of the shaft is avoided, and the constant felling of the pit by a lifting gate is secured.—10. That no person should be allowed to go in front of a tub or draught whilst in motion, but that every tub or draught should be brought to a stand on the level before the chain is attached. The number of accidents in ironstone mines was 21, being one more than last year, the number of deaths is the same—37; 1 life only was lost by explosion, 9 deaths were caused by falls of roof, nearly the whole of which were avoidable, and, in fact, the list, which shows 9 men were killed in the Lillidale colliery, shows such a flagrant case of neglect, that on the charter-master being summoned before the magistrates for not having sufficient timber set, he was committed to Salop Jail for two months with hard labour. Mr. Wynnie thinks that the educational clauses seem to him to be working better now that all parties are becoming more acquainted with their tenor, but he does not apprehend that they will be thoroughly effective until all classes of children employed in large manufacturing are placed on the same footing as the children of miners.

SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE DISTRICT.—Mr. J. P. BAKER has the pleasure of again reporting a decrease in the number of deaths in his district, but observes that it is greatly to be regretted that the deaths from falls of coal and roof are so heavy. He states that no fewer than 18 of the 79 deaths under this head were the result of disobedience to orders, or the provisions contained in the special rules, or disregard of the most obvious precautions, whilst the remaining 61 were caused by slips, joints, and bumps (or subsidence of strata), and other accidental causes, over some of which the working miners and the colliery managers in this locality have little or no control. He remarks that not a few of these deaths were owing to the manner in which the underground managers and workmen endeavoured to get down the overhanging coal and faces; and with a view to lessen the sacrifice of life by these causes, he has recommended, where it can safely be practically used, that the prop or timber should be set in the Lillidale colliery. This prop would give the workmen a safe place to get in before the blast took place, and thus prevent him incurring the risk of being struck down either by the fall of coal itself or the roof of the mine, which sometimes extends beyond the calculation of the best judges; in fact, nobody can possibly tell what a drop of coal may bring about, whether it be a heavy or slight fall. He considers that the great decrease of accidents in shafts is no doubt, partly attributable to the provisions in the Act of 1860, which gave the inspectors power to insist upon a cover overhead being provided when persons are ascending or descending, and prohibited the use of single-link chains; and, further, to the improvement in the fencing of shafts, and to some extent the adoption of the safety-chain. Of the 18 lives lost in shafts, 5 were clearly proved to have resulted from the carelessness and indifference to danger of the deceased persons when performing their duties in and about them. He is gratified to be able to state that a number of colliery proprietors have, during the year, fitted up some of their principal shafts with guides, &c., and this will tend still further to keep down this class of accidents. With regard to the accident at Kellie, where after the accident a defect was discovered in the rope not far from its junction with the cage, he says this defect ought to have been attended to when complained of, and the head rope should have suspended operations until it was remedied. This was stated to have been the only fracture visible. After the rope was uncoiled off the drum no other defect of importance was observable throughout its entire length, and with the exception of some broken wires it was to all appearance a sound one, as a subsequent hydraulic test proved it to be, for it sustained the respective strains of 9 and 12 tons, and the wire was of excellent quality. During the year reported upon 16 accidents occurred in ironstone mines, involving the loss of 28 lives—none by explosions, 7 by falls, 9 in shafts, and 12 miscellaneous, showing an increase of 7 deaths over 1861, the first year in which these mines were brought under inspection. Compared, however, with previous years, when the deaths in these mines were not required to be reported by the owners, the number of deaths in 1862 was not large, for the report made on this district for 1857 gives 49 as the number of deaths in ironstone measures in that year. Of the 7 deaths from falls, 4 unquestionably arose from carelessness, neglect of spragging, or non-observance of the salutary special rule No. 28, which provides "that every colliery shall securely sprag or spurn the coal whilst bolting, either in coal or ironstone mines, and also prop, where necessary, the roof of the place where they may work; and if he should not be provided with sufficient prop, he is to cease working, and report the same to the underground manager." If the observance of this rule were strictly insisted upon by the colliery managers, butties, and those having the oversight of the workmen underground, it would greatly diminish the number of accidents both in these and also in coal mines.

SOUTH DURHAM DISTRICT.—Mr. J. J. ATKINSON reports that in every class of accident the casualties and mortality of the past year have fallen

short of the average of the four preceding years. As it seems probable that upwards of 12,000,000 tons of coal were raised in that district during the past year, it may be inferred that considerably more than 200,000 tons were raised in proportion to the deaths than in any of the other inspection districts of the kingdom. How difficult it is to prevent accidents in coal mines, when not even the prospect of death will deter men from gross inattention, is lamentably illustrated in the case of a young hewer at Casco Colliery. A danger-signal had been erected by a deputy-overman, to warn the miners against entering with a naked flame, owing to an accumulation of fire-damp, and George Richardson was personally admonished of the fact, and set to work elsewhere for the day, in such a manner as to improve the ventilation. Nevertheless, when in want of a shovel, which he had left in the perilous part of the pit, he passed the danger-signal, and went into the forbidden quarter, carrying with him an unprotected light. The fire-damp exploded, and his rashness was punished by the forfeiture of his life. Falls of coal and stone are amongst the causes of death least open to limitation in number. Although the deaths from accidents of this class, Mr. Atkinson observes, have been fewer by about 37½ per cent. during the past year than on the average of the four preceding years, he does not attribute the reduction to any superior management or extra precaution, as he fears, from the nature of such accidents, but little reasonable hope can be entertained of their being permanently lessened in number, except to a trivial extent; at least in this district, where a special set of superior workmen are selected and employed, in a great measure to guard the ordinary workpeople from them. By one of the 18 accidents of this description, occurring in 1862, three lives were lost; and the calamity carries us back, in thought, to those distant geologic ages, from the period in which man made his appearance upon the face of our planet, and where vegetation was infinitely more vast and gigantic than in the present day. The three sufferers (two hewers and a putter) were at work in the colliery at Bitchburn, the hewers filling a tub, and the putter waiting till they had done, when the top coal, forming the roof of the place, suddenly and without warning fell, and they were all killed. A subsequent examination led Mr. Atkinson to conclude that the occurrence in the roof of a number of extremely large fossil trees, in the form of cones tapering upwards, had in a great measure been the cause of the top coal falling, in this instance, without being nicked. Mr. Daglish, viewer at the Hetton, Elemore, and Eppleton Collieries of the Hetton Coal Company, is making an experiment, in the interests of safety, which holds out promise of success. When accidents occur, agents in charge are fined; where none happen, rewards are bestowed. And hitherto reward has been the rule, and no exception has presented itself. The experiment was commenced in December, 1861, and in all that and the preceding five years there were nine deaths on the average, making 54 in all, there was not one in 1862. In expressing a hope that further experience may tend to prove that this system of penalties and rewards, now in operation at the Hetton Coal Company's collieries, has been at least one of the chief causes of the recent freedom from fatal accidents which has obtained in connection with it, the Government Inspector is afraid humanity must blush at the establishment of so humiliating a fact. The hope of gain and fear of loss are not, certainly, among the noblest motives to well-doing. All experience shows, however, how potent they are above ground as well as below; and if by appealing to them life can be saved and limb protected, let us be thankful, and leave poor humanity to the bluntness of the Act prohibiting the use of single shafts. The Act provides, as far as Mr. Atkinson can judge, general satisfaction in his district—only one case having occurred, at Tursdale Colliery, where exemption from providing a second shaft has been claimed, and there three arbitrators have been appointed to decide as to whether a second shaft or outlet is or is not to be provided.

LOCOMOTIVE CONSTRUCTION.—Notwithstanding the dictum contained in Clark's "Railway Machinery," we cannot regard the link motion as otherwise than imperfect. Its comparative excellence we admit; but with the growing tendency for higher pressure and early cut-off, its defects become day by day more prominent. In order to maintain anything like a fall pressure on a piston, moving at 800 to 1000 ft. per minute—a speed frequently reached in express engines—it is essential that all passages leading to the cylinder should be short, direct, and of large area, but that they should be opened and closed with a velocity proportionate to the speed of the piston. Locomotive valves seldom worked in the central notches, except when running fast. The travel of the valve is then shortened, and the ports not only reduced in area, but opened and closed with a tardiness, which greatly militates against the advantage to be derived from an early cut-off, diagrams taken at high speed showing a very remarkable loss of pressure as the piston pursues its course through the cylinder. Steam is estimated to flow into a vacuum with a velocity equal to that due to a body of the same density falling through a space equal to the height of a column of steam of a given pressure. By this rule, steam of 120 lbs. pressure would flow into a vacuum at about 2070 ft. per second; but the difference between the velocities of any two pressures, is the velocity with which steam would flow into steam of a lower pressure. At the commencement of a stroke, or rather at the moment when the valve first opens, the pressure within the cylinder is comparatively trifling, steam then enters with great velocity; once, however, the difference in the densities of the steam in the boiler and that in cylinders ceases to be well defined, steam passes very sluggishly from the former to the latter, and it is little able to overcome the resistance offered by long curved passages and the contracted areas of the steam-ports. It is very unusual, in consequence, that the valves should maintain more than a moderate speed, indicator diagrams are falling at once on the commencement of the stroke, long before steam is really cut off. The analysis of such diagrams is not easy, as it is impossible to tell, without setting out and measuring the valve-gear, when the valve really closed. Theoretically, the ports should be extremely short, straight passages, opening directly from the valve-seat into the cylinder. The great size of the valve required to suit such an arrangement has hitherto precluded its adoption. Mr. Clark gives us good reason to believe that as much as 25-horse power is frequently expended in working valves, as it is a positive waste of power, which it would be injudicious to add to. If, however, the valves are properly balanced, there is nothing to prevent the employment of any size deemed most desirable; and if we are to adhere to the link and eccentrics, the sooner we have a large valve with a long throw, and great lap, the better. We illustrate this week a form of balance-valve, which, although recently patented, has been worked for some time in America with considerable success. Fairbairn's slide-valves have been adopted on the Chemin de Fer du Nord since the year 1861 with excellent results, both in the Crampton express and Engeström goods engines. Railway companies do not like to alter, however, and the general introduction of the balance-valves, here at least, apparently is far off as yet.

Quitting the subject of valves, and resuming the consideration of the means by which they are put in motion, we find existing arrangements loaded for a simplicity which they do not really possess. The link motion—consisting, as it does, of two eccentrics with their rods, straps, pin, &c.; a link often built up of many pieces; and a rocking-shaft, with balance-weights or springs—is really the most complex part of the engine. Its expense is very considerable at first, and from the rapid wear to which it is exposed, and the nice adjustment which it must preserve, its maintenance forms a large item in the working expenses of the locomotive. We are well aware that the link motion is a distinguishing characteristic of any valve gear whatever; but we believe that other arrangements not a whit more complicated will give better results. The mere fact that such a piece of machinery, delicate and finely wrought, answering its purpose so well should rather encourage us in searching for a substitute which—not more simple, perhaps—would regulate the admission of steam to and its exit from the cylinders after a fashion approaching more nearly to theoretical excellence. Complexity is in itself no evidence of erroneous design; it only becomes reprehensible when it is introduced unnecessarily. In the construction of machinery the end justifies the means; and there is no reason that a valve gear which is of very excellent and simple construction well in America the use of the separate cut-off was long adhered to, and is even still held in high favour by many builders. At least one locomotive in the great Exhibition last year was so fitted, and it seems likely enough that its general adoption is not far distant. The variation in the lead, when the reversing lever is in different notches, is not the least objection to the link motion. The setting of valves is, in consequence, a positive science, and one understood, or at least practised, only recently. A few years ago it was quite exceptional to meet with a locomotive which "beat" equally. Even now, the setting of valves is a room for improvement, and the only reason why it is not the question of balance weights at one time considered, definitively settled, seems likely to be re-opened. It is extremely doubtful that it is good practice to perfectly balance the reciprocating parts of a locomotive. One locomotive superintendent has removed three-eighths of the accurate counterpoise from his engines, with manifest advantage. The solution of the problem lies, we fancy, in the fact that the pressure on the piston does not accurately represent that on the crank-pin, when the engine is in motion, because it is modified more or less by the momentum of the piston rod, and the connecting rod—to such an extent, indeed, in some cases, that the strain on the crank-pin is much greater near the termination of a stroke than at any other point, although the steam is early cut off. As the equilibrium of the impelling force on the crank-pin is extremely desirable, tending as it does to the steadiness of the entire machine, it is not improbable that a heavy cross-head, piston, and piston-rod may be better for high speed locomotives cutting off very early, than those of a lighter construction. There can be no doubt, however, that the wheels must be accurately balanced, and this rule is seldom or never disputed. In conducting experiments on the subject, care must be taken to distinguish between the conditions under which an engine is tried in the works, and under which it performs its work on the road.

There is little tendency to alter the practice which deems a single pair of drivers sufficient for express engines. Locomotives intended for high speeds seldom or never are burdened with heavy trains, and with rails in good order they manage to proceed well enough, but, unfortunately, not without doing great mischief to the permanent way, in consequence of the excessive loads placed on the drivers to secure adhesion. Still there seems to be much weight in the arguments which are urged against coupling wheels over 7 ft. in diameter, which make 270 revolutions before the minute. The momentum of an 8-ft. axle-rod at such a pace would be something tremendous, and its fracture would lead to fearful results. For ordinary passenger trains there is no excuse for limiting the number of drivers to two; and coupled engines are rapidly getting into favour for this kind of work. For aesthetic as well as mechanical reasons, the second pair of driving-wheels should be placed behind the fire-box, not forward. If inside cylinders are adopted, the latter position throws all the work out of the horizontal line, and entails many difficulties with the smoke-box and framing. A few large engines of this class are doing good service on the North-Western, between Birmingham and Stafford. The driving-wheels are, we believe, 6 ft. in diameter, and hence the cylinders do not come inconveniently near the ground. The only inconvenience, while the civil engineer regards them with unmitigated disgust, from their destructive effect on permanent way: 6 or 7 tons on a single wheel was, however, more than any iron tyre, possessing toughness enough to be safe, could bear without spreading; and to the employment of the hard irons which were resorted to as a remedy, may be attributed many of the accidents once so prevalent from the fracture of tyres. Railway companies have found it much to their advantage to purchase rails honestly made of good iron properly worked, instead of cheaper brands, which proved utterly worthless. Steel tyres, very in consequence, are still, a softer and more adhesive, and cheaper to work, and perhaps safer, in some respects, than steel. If a tyre could be made one, with the wheel rim proper, there is no doubt that its durability would be considerably increased; not only would its resistance to spreading be greater, but the shocks and vibrations to which it is exposed would be transmitted to the entire mass of the wheel, instead of being more or less retained in the tyre. Under the present system the tyre is exposed to a treatment nearly similar to that which it received in the rolling mill which gave it existence, the interior being nearly as much injured by the wheel rim, as the exterior is by the rail. Mr. G. S. Griggs, of the Boston and Providence Railroad, U.S., many years ago, set all his tyres on wheels to avoid this action. The ends of the wheels are made with dovetailed recesses all round, running in the direction of the axle. Into these recesses hard wood-blocks, thoroughly dried, are firmly fixed, with the grain running in the direction of the groove. The tyres are then shrunk on, resting wholly on the wood, which stands, say, an eighth of an inch or less above the surface of the wheel rim. Mr. B. Adams has brought out a far more elegant arrangement here. He introduces a continuous hoop spring, fitting within an internal groove in the tyre, between it and the wheel. Two of these hoops are, we believe, employed at present, each about one-third of the circumference of an inch or more. The wheel rim is turned slightly convex, and rests on the hoops, which of course surround

Experiments conducted on the St. Helen's Railway, Lancashire, show that St. Helen's tyres, fitted to wheels on this system, have given first-rate results when put in competition with Krupp's steel, Swedish, and Hood and Cooper's best iron, fitted in the common way. Krupp's tyres have run 40,873 miles, Hood and Cooper's 20,798, Swedish 94,006, without requiring turning up, as an average mileage; while St. Helen's tyres, fitted on springs, have run 55,138 miles, remaining in excellent condition. The engines had all 4 ft. 6 in. wheels, except the last, which had 4 ft., and their weights varied from 10 tons 10 cwt. on Krupp's, to 20 tons 6 cwt. on Hood and Cooper's, 23 tons 14 cwt. on Swedish, and 21 tons on Mr. Adams' tyres. The saving to the rails must be considerable, for tyres can only be worn out at the expense of the rails. This same question of tyres nearly concerns the property of railway companies. The maintenance of the permanent way is one of the heaviest items of expenditure which they have to encounter; and as the destroying element is found in the wheels of the locomotive, every improvement of which they are susceptible should be applied to them, without regard to the primary outlay, which is certain to repay itself a hundred fold.—*Mechanics' Mag.*

MINING IN SOUTH AUSTRALIA.

ADELAIDE, July 27.—The mining news of the past month has been of a more than usually important character. Several new discoveries—some of them, to say the least, of a very promising nature—are reported, and the mines at present in course of working appear for the most part to be going on satisfactorily. With reference to the new discoveries, one of them, said to be the most valuable, is probably 12 or 14 miles from the nearest mine hitherto opened in the district. It is on the River Finnis, about 12 miles from Strathalbyn and 10 from the Goolwa, on the south coast. A large well-defined lode of copper is said to be traceable for about 700 yards on the surface. The specimens brought from the place are very good, consisting of green and blue carbonates, with fine gossan, and some grey ferruginous copper ore. The mine is about to be opened by a private company. Another discovery has been made of a fine copper lode in the Murray Scrub, a few miles from the North Rhine Mine. The ore found here is richer than that on the Finnis; this land is also secured, and a party has gone up to commence working it. A third, and in some respects still more important, discovery has been made within 12 miles of Adelaide, on the same section as the old Victoria Mine, one of the first opened in the colony. This is also in immediate proximity to the old Montacute and other mines, and the discovery is very likely to lead to the re-working of these old mines, which are said by many persons acquainted with them to be well worth working, and likely to prove very remunerative under good management. Several mineral districts, long shut up, are receiving renewed attention, and from my own observation I think important results are likely to follow; and although some of the more remote mines may produce richer ore, those nearer to the centre of population and port of shipment have other compensating advantages. Operations have been resumed on the old Paranga Mine under favourable auspices, and with good prospects of success.

A marked improvement has manifested itself in the Kanmantoo Mine, in the course of deepening the engine-shaft, and the prospects are very encouraging. A fine lode in the bottom, above 4 ft. wide, yields 6 tons of rich yellow ore to the fathom. The West Kanmantoo Mine is also yielding fair quantities of rich ore. A recent discovery in the same neighbourhood seems likely to turn out well. The Worthing Company's mine at Callington, on the Bremer—one of the best worked mines in the colony—has progressively improved during several months past, and the able and energetic manager, Mr. Alfred Hallett, has determined—encouraged by the improvement—to sink the engine-shaft 10 fms. deeper, to the 63 fm. level. Two rich new lodes have been cut in the wonderful Moonta Mines, which even before this were celebrated for their riches. At the adjoining Yelta Mine, which has been perseveringly worked for about two years, with very poor success, a fine lode has just been cut, containing grey and black ore and malleable copper. The New Cornwall and Duryea Mines are also improving, and the original Wallaroo Mines are yielding more ore than ever. The new company to work the Matta Mine is nearly formed, and when it is so a fresh impetus will be given to mining at Wallaroo. The reports from the Yudanamatana Mines continue satisfactory, but if the traction-engines which have recently arrived answer expectations, I presume a greater number of hands will be employed on the mines, and more ore will be raised. Some new courses of ore have been opened both at the Yudanamatana and Blinman Mines, and the appearance of the latter especially is said to be very encouraging. The Yudanamatana Company deserve well of the colony for the energy and enterprise they have shown in the development of their mines, and in the importation of the traction-engines, which if successful will confer a lasting benefit on the colony. Should these engines succeed, I have reason to believe that others will be ordered from England by other companies or individuals. The country is full of mineral, and capital and labour only are required to develop deposits of copper, silver-lead, iron, plumbago, bismuth, nickel, &c., which would astonish the world as much as the gold fields of Victoria have done.

The *Telegraph and Weekly Mail*—the only paper which devotes special attention to mining affairs in the colony—alludes with satisfaction to the present aspect of the mines actually in work, and also to the prospects of the new discoveries. It says—"We seem to be troubled with a plethora of mineral wealth, for we have neither capital nor labour sufficient to develop a tithe of it."

It is unfortunate for the colony, as well as for the adventurers themselves, that so many persons in England who have invested capital in colonial mines have lost by so doing; but I think in some cases this is traceable to a want of due precaution on their part, while in others, no doubt, it has been the result of unforeseen circumstances. If they were to employ an agent of integrity in the colony, and one having some knowledge of the mines, their risk would be greatly lessened, and it is probable they might invest capital to great advantage. Persons in the colony have lost as heavily in proportion, perhaps even more so, than those in England, from too great eagerness to invest in any mine that is well publicized. To the credit of the press of the colony, I may say there is no disposition on its part to countenance any bubble scheme. Attempts may be made on the part of individuals to gull the public, but they would be soon exposed if brought prominently forward. We sometimes hear for the first time, from an advertisement in your columns, of companies to be formed for working mines unknown in the colony; but, as I said before, a reference to some agent here of respectability and acquaintance with the mines would generally protect them from loss from any nefarious projects. I hope to see the day when hundreds of thousands sterling of British capital will be profitably employed in working our mines. When the mines of Cornwall run out, you can move the whole mining community to South Australia.

FOREIGN MINING AND METALLURGY.

With respect to the Belgian metallurgical market, it may be noted that transactions in scrap iron continue to present a good appearance at Charleroi; they are generally concluded at a slight advance upon the prices current last year. Manufacturers of rails have scarcely any goods in warehouse, so that a large production must be anticipated this winter. This is not, however, the principal cause of the rise in cast iron; the present movement being the natural consequence of a better state of the market. Merchants' iron are the subject of numerous transactions, but the inveterate competition which some producers carry on injuriously affects the good tone of prices. In Switzerland especially, if Belgian producers do not obtain contracts on better terms it is their own fault, and not that of their foreign competitors. Deliveries of coal have been, to some extent, checked in the Charleroi district by a scarcity of boats, arising from the difficulties which navigation experiences on the junction canal and on the French Sambre. On the Meuse, navigation has also not been yet resumed in consequence of want of water. To return to the iron trade, we may note that the rolling works are extending their production; the construction shops are also well occupied, but they are working at low rates. Casting pig sustains itself on the Charleroi market, notwithstanding the competition of English pig, which supplies in a great measure France and Flanders. At Liège, the ironworks are in great embarrassment; they cannot literally satisfy the orders received and presented, and the Doihain blast-furnace, which has been for some time out of blast, is about to be re-lighted. In a word, Belgian industrialists begin to see their hopes realized; rails are steadily sought after on foreign account, and in addition to important orders for Spain received of late, other deliveries are expected to be shortly secured, so that a confident belief is entertained that the season which has just commenced will witness a sensible amelioration in the position of metallurgical industry in Belgium. At Charleroi, casting-pig is quoted with a rise of 3s. per ton. Casting-pig, No. 5, makes 37. 16s. per ton, with a scale of 2s. per number; hard iron, for refining, 37. 2s. per ton, taken at the works.

So much for Belgium. With respect to France, it may be noted that the works of the Moselle district are much occupied, and that abundant orders continue to arrive. Prices have not materially changed; they are not only very firm, but also display an upward tendency, and the rise which has been established in some instances will, probably, become general if the present demand is maintained. The Horange works have been adjudicated to M. Aube, Junr.; it is feared, however, that a contest may arise between the share and obligation holders, which would interpose an obstacle to the putting the forge in activity. This would be unfortunate, as the Longvion and Longvion Railway is now in operation, and the works are better placed than they were formerly supposed to be. One of the lots of the Grandville property has been adjudged to a landed proprietor of the district, and it is believed that he purchased it for the purpose of demolishing it; the other lot did not find a buyer. The house of Wendel is installing a colossal foundry in its works at Hayange, and M. Labbe is actively pushing forward the construction of furnaces at Longvion. The forge of Ottange have scarcely made the progress which was expected from them. The Monteban works are now delivering plates of extra hard iron for the works of La Ciotat and Havre; notwithstanding that they have to traverse a railway journey of between

300 and 600 miles, the Monteban establishment sells its products in competition with the fine plates of the Low Moor works; and, having regard to price and quality, it has secured a preference over its celebrated English opponent. At the Besancon forge-masters' fair, just held, a fall of 8s. per ton was noted. The fall was accepted after a hard struggle on the part of the producers; but, as they had not the time to accumulate stock, they were forced to sell at a sacrifice. It is said that some furnaces will be put out of blast in consequence of the reduction, which appears strange, having regard to the animation and confidence reported in other parts of France. At St. Dizier prices of pig for refining have remained at as nearly as possible 47. per ton. A transaction is reported in which 600 tons changed hands, at 47. 18s. per ton. The rolled course of this description of pig at St. Dizier, in August, was 47. 2d. per ton. Moan iron from wood-produced pig have been quoted at 37. 12s. per ton first-class, and 37. per ton from mixed pig, with a scale of 3s. per ton between the classes. Special iron have made 37. 12s. per ton, with a scale of 3s. per ton between the classes. Sheets, 101. 16s. to 111. 4s. per ton first-class, with a margin of 16s. per ton between the following numbers: machine, No. 20, 101. 4s. per ton; ditto, No. 21, 101. per ton; hammered iron, 101. 16s. to 111. 4s. per ton in warehouse at the works. Prices of iron at Paris present great firmness, but the rise which houses represented at Paris expected has not been realized. The revival which has appeared in iron has, unfortunately, not yet reached casting industry. The situation of this branch of trade does not improve, and scarcely any hopes of a favourable change are entertained, even at a comparatively distant period. This state of affairs arises from two circumstances: first, as regards stocks, from the complete absence of cold during the winter of 1862, the warehouses of merchants being encumbered, and comparatively few orders being, consequently, given out; and, secondly, as regards castings in general, from the severe competition of the second fusion foundries of the Ardennes, which are now selling their products at 101. 8s. per ton, delivered in the warehouses of merchants. These prices, which cannot be competed with by the manufacturers of the St. Dizier district, are said to be remunerative in the Ardennes, in consequence of their far more advantageous conditions of production, as they employ exclusively foreign pig—English and Belgian—costing them, when re-cast, less than that produced in the St. Dizier group. It is reported from Toulon that a heavy contract was about to be concluded for plates for armour-plated ships now on the stocks, and which are to be completed in the course of the year.

The question of the new coal tariff of the Northern of France Railway Company appears to be not yet finally disposed of. It was thought that the Minister of Public Works had given to the French industrialists all necessary explanations as to his motives in arriving at his recently-announced decision; but it appears that the colliery proprietors of the departments of the Nord and the Pas-de-Calais have not yet lost all hope of seeing the decision revoked, and they still contend that it is hurtful to their interests, and contrary to the measures which ought to be taken to assist the profitable and fast development of the French northern coal basin. An occasion of protesting against has been seized by the industrialists interested, who have rallied to their aid the general councils of the Nord and the Pas-de-Calais. In a recent sitting of the first of these councils expressed a wish that the Government would retract its steps as regards the homologation which it has accorded to the new tariff, and that it should oblige the Northern of France Railway Company, in future, to respect proportional tariffs, and to take account of mileage distances in any propositions which it may make for tariff reductions. The general council of the Pas-de-Calais, notwithstanding its opposition to the new tariff, has, however, decided to support the decision of the Northern of France Railway Company, decided on referring a petition of the collieryowners of the department to the prefect, with a request that he would make known to the Minister of Commerce and Public Works the uneasiness which the application of the new tariff had occasioned in the coal basin of the Pas-de-Calais. The question has increased in gravity, in consequence of two opinions having come into direct collision with each other. On the one hand, the Minister of Public Works, in homologating, or officially approving, the new tariff, has been guided by the principle of general liberty of commerce; while on the other hand, the collieryowners, and from a selfish point of view, have been guided by the principle of protection, and from a general interest as on that of the French coal trade. From a Belgian point of view, the decision of the Minister is regarded with approval, but every district, of course, looks at matters with a view to its own advantage.

With respect to the Paris copper market, it may be noted that business has been inactive, and prices have displayed a slightly downward tendency; English in plates has been quoted 957, Lake Superior 1077, and rough Chilean 887. At Havre some sales of Chilean have taken place, and about 80 tons have been dealt in at 897. per ton; nothing doing in other descriptions. At Hamburg the demand continues good, and prices have been very firm, the Cologne market has also been well sustained. At Berlin purchases for consumption have been steadily continued. Banca tin has remained quiet, and without much business being done in it at Amsterdam. Preceding rates have been maintained at Paris; Banca has been quoted 1307, Detroit 1267, and English 1167. Berlin and Cologne have been heavy, and at Hamburg affairs have been quiet, without variation in prices. Lead has been rather feeble at Paris, rough French being quoted 211. 14s., and Spanish 37. 12s. per ton. At Cologne the article has been sought after to a comparatively small extent, but at Berlin it has been firm, and in good demand. Soft German lead has been a little better, but not so much so; but, however, better receipts without demand. At Paris transactions in zinc were less important; quotations of rough Silesian have, however, been firmly sustained at 207. per ton. The demand has been rather more quiet at Breslau and Hamburg; at the same time, the high rates acquired are maintained with much firmness.

Some valuable mines of graphite have been discovered in Russia, by M. Alibert. Allusion was made, we believe, to this discovery some weeks since under this head, but a few further details may, perhaps, be acceptable. M. Alibert, who is a pupil of an eminent deceased French professor of geology (M. Dufrenoy), discovered the bearings 15 years since in Eastern Siberia, in the Government of Irkutsk, on the frontiers of China. This mineral, called plumbago by some—but erroneously, as it does not comprise an atom of lead—is used in the production of crayons. It is very rare in Europe and England, and consists of carbon, mixed with 2 or 3 per cent. of iron, and some small quantities of volatile substances. The mines discovered by M. Alibert in the mountains of Suciua, in Siberia, and of which he is assured a concession, are of inexhaustible richness. It required, however, 15 years' perseverance to sink pits, open galleries, and form a staff of miners. M. Alibert was at last successful, and the mines are now being worked by a company, in which a monopoly of the mineral is reserved to him. To enable some idea to be formed of the importance of this house, it may be noted that it delivers annually to commerce 20,000,000 crayons. M. Alibert has presented the Musée d'Histoire Naturelle, at Paris, with a block of graphite, artistically worked, representing the bust of the conqueror of Siberia. This bust is supported on a block of jade, or nephrite, weighing 2 cwt.; jade is an extremely rare marble, of which the sceptres of Chinese emperors are made. M. Alibert has also presented trophies in graphite to the Conservatoire des arts et métiers, at Paris, the private museum of the Emperor Napoleon, and Montauban, his native town.

FOREIGN MINES.

ALTEN and QUEENANGEN.—Aug. 29: We are able to corroborate the continuance of the late improved prospect at the mines. Yesterday I received intelligence from Queenangen of the same cheering character as last reported. The lode in the 10 fm. level workings west of the same rich description, but varying in quality, though when the messenger left the lode was much larger, and signs of the footwall were visible. In the sink under the lode the lode had considerably improved, two small veins having dropped into the working; the ore part of the lode was over 1 ft. broad, and producing ore of excellent quality. The progress making at Queenangen is satisfactory. I was at Queenangen lately, and was glad to see the progress of the new good ore from the shallow workings and from the heavy spar lode, promising a continuance, and this I hope will prove the case until we can further develop the lode in the 30 fm. level. On the Kanford side we continue to do well, and there is much steadiness of character in most of the workings. The smelting operations are closed, and we hope shortly to present you the result for the past year.

SANTA BARBARA.—Capt. Bryant reports (Aug. 13):—Mine: The lode in the bottom of the shaft is going down more perpendicularly again, and is consequently easier for quarrying. As stated in the general report, we have now four stopes working south of the shaft, and one north; the appearance of the lode is much as it has been for some time past. No. 1 will be cleared this month. In clearing the old level lode we are progressing favourably. In the shallow level south we have been in a position to stop a portion of the lode in the course of a few days. In the trial level north we have got into regularly stratified ground, which will stand with very little timbering, and have commenced cross-cutting in search of the lode, which we hope now to intersect shortly. Captain Bryant informs the board, that in consequence of the experiments in connection with the amalgamation process not being perfectly completed, he defers forwarding the result at present, but fully expects to be in a position to do so by the next mail.

BEARIE TIN MINES.—Highly satisfactory accounts have been received from these mines. Capt. Bray, on 10th inst., reports as follows: "Progress of work, Biddle, Newing-floors, &c.: The drain for carrying off the tails, &c., is now finished, and the greater part of the second round bustle is fixed. We are now preparing for the construction of three small hand-buddies, close to the round ones, for cleaning the work after the latter. As these works are entirely unsheltered, it will be necessary to erect a shed over the floors, in order to keep the works in constant and uninterrupted progress throughout the most productive season. The space to be covered in will be about 70 ft. in length by 20 ft. in breadth, having some 1200 ft. of wooden flooring. The floors for the round and the two hand-buddies already erected are constructed of rough flat stone. This is a necessary for the corner work, but the floors for the smaller buddies, which will be our principal cleaning floors, must be constructed of wood, stone being too rough for fine and good work.—San Miguel, Deep Adit: Distances driven 15 yards; re-set at 45 yards per yard. The end is now in a large bed of clay of fair average quality. We are now putting up another rise to the bottom of the level driven at the side of the mouth of the railway level. The end of the deep adit is now about 15 fms. beyond this rise. As soon as we have water for the stamps we shall drive cross-cuts on both sides of the main level, to ascertain the lateral extent of the bed, making preparations at the same time for stopping away the clay for the stamps. From this No. 4 we are now driving about midway between the deep adit and the railway level, upon a piece of clay running eastward. This driving will enable me to determine as to the best means of getting out the clay here—either by removing the overburden or by driving and stopping. Our prospects in the deep adit are better now than ever they appeared to me before. There is no doubt of the bed on which we are now driving being the same mass of clay coming down from the mouth of the railway level, the position of which will be seen in the sectional sketch of that level transmitted to you. The chief consideration in getting it out for the stamps will be the way of the roof, of which it is impossible to form any precise opinion until the work is opened beneath.—Railroad: Distances driven 4 yards; rounds still hard, although there was a little change for the better during some part of the month. The shaft being sunk from surface above the end, called Railway shaft, has gone down 33 ft., through very hard clay and quartz. At that depth the kilias was cut, of which about 4 ft. has been sunk through up to the present date, the kilias hardening as it deepens; present price, 80 cents per yard, but shall have to advance the price, in consequence of the nature of the ground, which is very similar to the end below. Around this shaft the quantity of clay must be very great, but to give anything like an approximate estimate is plainly impossible, the bed being away down to the south-east, although a great extent of it is uncovered. If it continue down at the angle of the obliquity of the dip at surface, the end of the Railway level will be in it at about 20 fms. and 30 fms. from the present point of progress. We are now driving through the clay from the rise in back of this level, and preparing for stopping for the stamps; present price for driving and tramming the clay to shoot No. 1, in deep adit, 12 cents per yard.—San Guillermo: The cross-cut has been driven 4 yards 2 ft.; ground easier for driving; re-set at 250 yards per yard. During the last month a small deposit of hard clay, of little or no value, was driven through; beyond this the ground has improved, and is now a fine, soft, siliceous sand. Trial shaft No. 1 sunk 27 ft.; no indication of lode, now sinking at 25 cents per yard. Trial shaft No. 2 sunk 35 ft. in all, when the ground became extremely hard; a driving was then commenced from the bottom of the shaft westward towards the lode; driven 3 yards; re-set at 25 cents per yard.—La Union: The stopes in bottom of the old adit has been continued to within 3 yards of the end, on reaching which

we shall commence driving.—San Francisco Adit: Distances driven, 3 yards 2 ft. 8 in.; ground a little improved for driving; re-set at 250 yards per yard.—San Patricio: Distances driven, 5 yards 1 ft. 6 in.; the end is close under the stopes where streaming was carried on last year; we are now putting up a rise to the surface. There is no change in the end, which still continues extremely hard, above the clay is soft; this rise will determine how far the soft clay extends downwards, and how far the hard extends upwards.—San Adolfo: End driven, 1 yard 2 ft.; re-set at former price. A small vein of hard clay has been cut; the main bed cannot be far off. During last week a few showers somewhat accelerated the progress of the stamps, but no steady rains have yet set in to bring us a continuous supply. The August produce of ore being as yet a quantity was not taken up, and will be included in the returns for the present month. As to the estimated quantity of clay uncovered or got at by driving, and ready for transmission to stamps on July 31, it is really impossible to answer this question with any approach to accuracy; I can only confidently assure the board that we have sufficient here for several years; with the stamps at the full work calculated for them. The peculiar and eccentric conformation of the beds renders impossible any calculation as to the entire quantity. It has already been seen that the supposed two distinct and separate beds in the Railway level were proved by the back driving to be one and the same, partially separated by the kilias which had gone down between them. It was supposed that the beds in the Railway level and that in the deep adit were equally separate, and the works we are now continuing have placed almost beyond a doubt the fact of the identity of those beds. Now, those beds were partially uncovered before, and it was only subsequent operations that proved the fact of their identity. In the face of these facts it is impossible to fix upon any quantity, and I can only repeat to the board my confident assurance that we have sufficient clay at our disposal to last for several years, constantly working it.

ST. JOHN DEL REY MINING COMPANY (Limited).—Advices received Aug. 31, per Oueda, from Brazil:

Morro Velho, July 29.—NATIVE FORCE: At present we have an ample supply of hoppers for our stamps. Their attendance has so far this month been more regular than usual. The natives are decidedly becoming more settled in their work and residence here. The lowering of the prices in the general articles of consumption in Congonhas this year, and the improved means now afforded them of getting their supplies, will tend much to induce labourers to remain in this company's service, especially when the many advantages they enjoy, not to be obtained elsewhere, are taken into account. GENERAL OPERATIONS.—During the past fortnight our hauling operations have been frequently interrupted by the breakage of the hauling chains, especially in the Cachoeira Mine, where in the middle section inclined hauling shafts regulate between the inclined planes and the stopes. The failure has been in the quality of the iron used, and not generally in the workmanship. Our pump-work has acted well since the improvements have been effected in it, and the new rods put in answer the purpose in view remarkably well. In the mines the native force has been good, large, and regular, and there is at present a very fair supply of stone quarried, but our difficulty in getting it to the spalling-floors has arisen from breakages in the hauling medium, and the stoppages which these occurrences always occasion. The stopping throughout the mine has been carried on regularly, and a fair amount of duty done in this respect. There is also a good force employed on the timberwork, in which progress is being made. There is no change to report in the lode or its condition.

REDUCTION DEPARTMENT.—In this department the diminished supply of water is felt, and the several interruptions to the hauling have deprived the spalling floors of the supply of ore there would otherwise have been available for the stamps. The Herring stamps have had a fair supply from the Bahu Mine, but the others, especially the general stamps, have not been adequately supplied with ore for reduction, hence we cannot expect an average gold return. The amalgamating process has been carried on regularly, and a large quantity of sand is now treated without any inconvenience to our barrel or sack accommodation. The spalling has scarcely been so good as it would have been had the supply on the floors been more regular.

PRIMA WORKS.—We have had a day and half stoppage here of the Illingworth water-wheel, for the purpose of putting in two new driving pinions on the stamps' axle. Advantage was taken of this stoppage to repair the wheel and improve the launders which convey the water to it. It may be hoped that these repairs will make the stamps more effective. The usual operations at the mine, with the above exception, have been carried on with vigour and regularity during the past fortnight, and there is now a good stock of material to operate on. The sand received during the past ten days is not quite so rich as usual, owing to the less adequate supply of ore stamped at Morro Velho.

GOLD EXTRACTED TO DATE.—The produce of the stamps for the 24 division of July, which on this occasion was only a period of eight days, is as follows:—

	Oitavas.	Tons ore.	Oit. per ton.
From general stamps	4,683	from 913.0 =	5.129
" Herring (East Bahu)	2,272	" 252.8 =	8.987
" Lyon (W. & Mid. Cachoeira)	942	" 296.0 =	6.560

Total stamps produce 8,897 1461.8 = 6.036

Taking into account the supply of ore available, the foregoing produce is as good as can be expected. It should be stated that the Cotesworth stamps have been stamping hard kilias and quartzose stone, and that during the division the general stamps were sometimes not entirely supplied with ore, so that the general stamps yield per ton is lowered to 5.129 oit. The yield from the Bahu, as shown in the Herring stamps, is 8.987 oit. or almost 9 oit. per ton. At the date of this letter the supply of stone on the floors is very fair, affording sufficient ore for the daily consumption of the stamps. The gold troop left July 28, taking 18 boxes of bar gold, containing 63 bars, and weighing in all 85,154.6 oit. = 818.078 lbs. Troy. The gold is forwarded to the agents for sale to the Bank of Brazil on the most favourable terms, assuming the rate of exchange on London will continue as it now is, about 2s. 2½d., making it desirable to dispose of the gold in Rio.—N.B. The gold has been sold at Rio.

Advices received Sept. 19, per French steamer *Estimadura*, via Bordeaux.

Morro Velho, Aug. 17.—PRODUCE: The produce for the month of July amounts to 40,017 oit. It has been derived as follows:—

	Oit.	from 3560.0 =	5.357
From general stamps	19,164	" 3560.0 =	5.357
" Herring (East Bahu)	8,858	" 1011.2 =	8.759
" Lyon (Mid. and West Cachoeira)	7,998	" 1200.0 =	6.615

Total stamps produce 35,740 5771.9

From arrastres 1,927 = 0.533

Prima produce (stamps and arrastres) 2,350 = 0.525

Total produce 40,017

In a previous letter, under date the 29th ult., the cause of our limited supply of stone for treatment was explained—breaking of the hauling chains interrupting the hauling. The last division of the month now included in the above return gave us a better yield and produce—yield per ton 6.796, and a daily return of 125.0 oit. from the stamps. The return from the general stamps is small, owing to the limited supply of mineral we had during the greater part of the month, but the part of the arrears produced in the week, considering the quality of the sand available, and the produce from the Bahu, was very good. The standard yield is nearly 1½ oit. under the return obtained in June. This has not arisen from any change in the mineral, but from the inadequate supply on the spalling-floors, to admit of the whole of our stamps being kept operating on ore. There was a good supply quarried in the mines, but interruptions prevented our getting it to surface.

COST AND PROFIT.—Produce for July is .. 40,017 oit.

Deduct loss in melting 175 oit.

Leaving bar gold 39,842 oit.

Which at 7s. 9d. per oit. amounts to £15,438 15 6

The cost for July is Rs. 83,535 £760, at exchange 2s. 3d. 9,960 5 6

Thus saving a profit on the month's working of £5,478 10 0

The above cost is about the same as was incurred in June, but the lower produce has caused a lower amount of profit. The outlay for labour is still heavy, and during July we had more than usual cost for certain work, owing to the irregularities and interruptions which arose in getting up the quantity of stone required from the mines.

General prices of provisions and supplies are moderate, except oil, which at present is rather limited, and consequently brings above the average price.

REDUCTION DEPARTMENT.—The duty performed in July in this department may be seen from the following summary:—

Stamps working 31 days, average	137.75 heads
Stamps working 135 heads, average	30.48 days
Arrastres each worked	22.30 days
Arrastres each produced per oit.	5.393 oit.
Arrastres produce on that of stamps	8.39 per cent.
Produce of each stamp head per diem	8.63 oit.

The quantity of sand amalgamated during the month amounts to 4272 cubic feet, which yielded 8.80 oit. per cubic foot. The unrecovered gold contents appear to be 24.50 per cent. The low return from the sand treated shows clearly that it was much below the average in its gold contents. The quantity of ore reduced amounted to 5777.8 tons, and the kilias rejected to 1605.6 tons. There has been more ore reduced in July than in June, but this has arisen from a certain proportion not being quite pure, having an inferior quality of mineral treated in one of the stamps—the Cotesworth—and in this way the duty is increased, but the average yield of the whole body is thereby reduced. There have been some heavy repairs done to the arrastres, and their working time so far diminished, but the gold return therefrom is better than we have had for some time. The amalgamation of the sand has been carried on steadily, and the duty on the spalling-floors has been more difficult than usual, owing to the irregularity of the supply of stone there.

PRIMA WORKS.—Towards the end of June, as previously advised, there was about a day and half stoppage of the Illingworth stamps for the purpose of putting on two new driving pinions on the stamps' axle. With this exception the machinery, stamps, and arrastres have been kept steadily at work, though not at full rates of speed, owing to the extent to which the diminished supply of water is now felt here. The produce for July is as follows:—Stamps, 1534 oit.; arrastres, 816 oit.;—2350 oit. The stamps had not so good a supply of hard material as during the previous month, owing to some of the best quartzose stone being taken at Morro Velho for the Cotesworth stamps. The produce is good for the time, and the rate at which the stamps and arrastres have been employed.

MINE.—The native force during July has been higher than in June.

There have been boring—Natives, 280.42, others, 41.43=321.85 daily average.

The total natives employed in the mine gave 377.58

Other force 488.89

Making a total force of 866.77

The quantity of stone delivered at the surface, as per mine account, amounted to 3351 wagons, which gave an average of 26.04 wagons per bar. There was, however, a stock of stone in the mine at the end of the month, which, if it had been hauled, would have increased this duty a trifle. Besides the interruptions to the hauling, the highest hauling machine, the Gamba, has at present a very small supply of water, and this impedes the ordinary hauling very much, from the localities worked by this machine; indeed, the diminished supply of water at present is considerably felt at the hauling engines of both mines. There has been a good deal of general timberwork effected during July, especially in the heavier repairs of stall work. Some new pillar work has been advanced a little, and cross and shaft pieces supplied in both mines. The sinking has been carried on with vigour in the Cachoeira, and the stopping throughout both mines regularly prosecuted from east to west. There is not any change in the appearance or quality of the lode perceptible in either of the mines.

WEST QUEBRA PANDELA.—The sump here is still in hard ground, and the back of the shaft has given some trouble towards the end of the month, and thereby the sinking was somewhat impeded. There is not any change in the quality or appearance of the lode worth noting.

GOLD EXTRACTED TO DATE.—The produce of the stamps for the first division of Aug., being a period of 10 days, is as follows:—

	Oitavas.	Tons ore.	Oit. per ton.
From general stamps	6322	from 1159.0 =	5.459
" Herring stamps (East Bahu)	2812	" 334.0 =	8.400
" Lyon stamps (M. & W. Cachoeira)	2323	" 347.2 =	6.694

Total stamps produce 11,457 1839.6 = 6.292

The return per ton from the ore treated in the General stamp is not so good as was

obtained in the last division of July. In the separations the yield has been good, considering the supply available, and the present power of reduction we possess. The supply of stone on the spalling-floors is very fair at present, and the general operations are going on steadily.

THE TWELVE APOSTLES MINES.

SIR,—Mr. T. P. Thomas, very much to my surprise and regret, having published in last week's Journal an attack on these mines, I have, to save your space, replied to the same at some length in my Circular (No. 22); but I beg to send you a most important report from the mines, received this day, the truth of which cannot be impugned by Mr. Thomas, because he has had an opportunity of perusing it, and appeared to be much enlightened by having done so as to the real merits of this property. A report Mr. Thomas has received from his own agent (which I have seen and read) is an excellent one also; and I hope to see the same in print, if only to utilise the adage—"audi alteram partem." Mr. Thomas has made a mistake, but I think he will correct it, and so do justice, not only to the Twelve Apostles, but to your correspondent of 20 years' standing.

1, Finch-lane, Sept. 23. JAMES CROFTS.

THE TWELVE APOSTLES AMALGAMATED MINES.

SIR,—I was disappointed to find you omitted to insert the information I sent in last week's Journal. It is to be regretted, because it would have had the effect of neutralising the unfavourable remarks of Mr. T. P. Thomas.—I. He observes that "bold statements are being circulated as to the extraordinary amount of profits and returns being made." The statement of profits and returns I sent you is correct, I can vouch for, and it can be proved by reference to the manager, or the books of the company. There is no "boldness," therefore, in my statements to you.—2. He asserts that these mines have been worked by the new company but a short time, and are without any machinery. It is a fact that the mines are now without machinery. But there are eight shafts, all of which are yielding ore; and if we can bring to grass 100 tons every month by the kibble, what should we do if we had machinery for lifting the ore? We shall begin with a vigorous board of directors, who are not likely to keep the mines at their present working; but the absence of machinery, instead of an objection, actually tells in our favour.—3. The royalty is asserted to be heavy, and the sett small; and our eastern, western, and southern workings within a yard or two of the Central Mines boundary. The royalty is the same as the old mines, and most of the other miners settle. Our sett, including the West Miners and Rock sett, is about 40 acres, which cannot be considered "small." As to the workings being near the boundary, this applies to a very small part only of the Twelve Apostles ground, the bulk of which is not yet opened.—4. As to the increase of capital. This was done partly to purchase the rock sett, partly for the benefit of the old shareholders, and partly for working capital. It was by no means "regulate," and could have been dispensed with; but the shareholders so decided in general meeting, and hence the result. Their objects were to do away with the system of monthly calls, realise a bonus, and purchase the Rock sett, which is considered as valuable as the Twelve Apostles.—5. Mr. Thomas states he is "conversant with their history." It is not quite clear whether he alludes to the Twelve Apostles (the miners), or the mines; but as he is so reticent, I can supply you with the information he cautiously withholds.

Many years ago some workings miners discovered a large quantity of ore on that part of the Miners Mountain called the Elsteddoff estate, the property of Mr. Thomas Tipping, deceased. These miners were twelve in number, and they secured a sett for themselves. Having no capital, they commenced, and in a small space of ground, with very imperfect working, they managed to extract about 10,000l. worth of lead ore. These lucky men were christened "the Twelve Apostles," and some of them saved their money like prudent men, whilst the rest spent it in dissipation and folly. They managed to sink two shafts only, when they were overtaken with water. They sold the lease of the mine, which became the property of Mr. Thomas Williams, of Coedpoeth, near Miners, who commenced a company, about twelve months ago, to work the mine on the cost-book system; their capital was raised from 1620l. to 2000l., and afterwards to 4000l. A large quantity of lead has been raised and sold for the benefit of this company, whose prospects have been all along of the most flourishing character. In December, 1862, another sett, adjoining the Twelve Apostles, was secured by Mr. Thomas Williams, called "the West Miners." This contains about 14 acres, and is in a direct line with the Old Miners Mine. A company was formed to work this mine, with a capital of 500l. which was afterwards increased to 2000l., all of which was immediately subscribed. The prospects of this mine are more important than the Twelve Apostles, and it is expected that the principal lode of the old Miners runs through the entire sett; if this be the case, its value cannot be estimated.

Three shafts have already been sunk on the sett, and the ground is rich for lead wherever it has been opened out. In sinking the lower shaft, large lumps of ore are being turned out continually. The above two companies agreed, about three months ago, to amalgamate, and increase their capital to 12,000l. The reasons for amalgamation and increase of capital were manifold. The setts adjoin each other, and could be more easily worked together under one management. The system of monthly calls would be dispensed with; and it was found essential to purchase an adjoining sett, called "The Rock," by means of which important advantages would be secured, whilst it contained in itself very rich mineral ground. To attain these objects the amalgamated companies resolved to abandon the cost-book, issue fresh shares, and become incorporated as a new company, under the title of "The Amalgamated Elsteddoff West Miners, Twelve Apostles, and Rock Mining Company (Limited)." This is a short history of these mines. They are by no means a small sett, but contain some of the richest mineral ground in the county. Our expectations are very great. When the West Miners ground is opened out, and we get to a deeper level, we confidently look for an intersection of the old Miners lode, which has been carefully drilled, and runs in a direct line through the West Miners sett. With our present yield of lead and our future prospects, we have a right to be bold in our statements, though not in the spirit instigated by Mr. Thomas. Under the new management, these mines are destined to become a valuable property, and the friends of the adjoining setts will try in vain to disparage or injure the reputation of our company, for it will be certain to take a first-rate position in mining circles. I should add, that in the Twelve Apostles not only blue, but white lead is found in great quantity. When the original Twelve Apostles were working their mine they threw aside some hundreds of tons of white lead, which they considered of no value; this will shortly be dressed for sale and yield a large profit.—*Shrewsbury, Sept. 21.* JOHN MORGAN.

P.S.—Since the above was written, I beg to inform you our solicitor has received a letter from the manager (see copy sent herewith), giving a positive denial to the statements that the men have been dismissed, or not properly paid; it is totally false, and it seems the man have never, on any occasion whatever, been kept out of their money, which has always been paid to the day. I was wrong, therefore, in admitting the slightest irregularity. The manager as positively negates the allegation that the men have been paid in goods. This is a gross calumny, and the invention of some interested or hostile person. He sends very cheering news. A rich bearing vein has been discovered in sinking the last new shaft in Twelve Apostles on Friday last; at 40 yards they raised 3 tons in two hours and a half. This vein gets stronger as the work goes down. The captain values the discovery at several thousands; but, at all events, it is splendid news.—J. M.

PUBLIC TEST OF WIRE-ROPE.

THE SUPERIOR QUALITY OF GARNOCK, BIBBY, AND CO.'S WIRE-ROPE WAS FULLY PROVED BY A RIVAL MANUFACTURER AT THE LIVERPOOL PUBLIC TESTING MACHINE, on the 29th of October, 1860, on which occasion GARNOCK, BIBBY, AND CO.'S ropes were found to be the STRONGEST of all the TWELVE SAMPLES from different makers then tested, as reported in the papers of the day. For example:—
(Certified by Mr. William Macdonald, superintendent.)
Garnock, Bibby, Corresponding sizes from other manufacturers.
Size. Tons c. Tons c. Tons c.
3 1/4 in. 18 5/8 16 10 11 10
2 1/2 in. 8 15/8 7 15 5 0
Remaining sizes with similar results.
• Samples taken promiscuously from stock by a rival manufacturer's agent.
GARNOCK, BIBBY, AND CO.,
SWAN HEMP AND WIRE ROPE MANUFACTURERS,
LIVERPOOL.
FLAT AND ROUND STEEL AND IRON WIRE ROPES FOR MINES, &c., of SUPERIOR QUALITY.

CREASE'S PATENT EXCAVATING MACHINERY.

FOR SUPERSIDING THE SLOW AND EXPENSIVE USE OF MANUAL LABOUR IN SINKING SHAFTS, DRIVING LEVELS, TUNNELLING, &c., is guaranteed to drive through any rock of average hardness at a minimum rate of 1 ft. per diem, and to sink shafts at the rate of 2 fms. in three days.

Mr. CREASE will undertake contracts for sinking shafts, driving levels, &c., at an enormous reduction of time and great saving in cost. Applications to be addressed (for the present) to the patentee, Mr. E. S. CREASE, Tavistock, Devon.

BASTIER'S PATENT CHAIN PUMP.

APPARATUS FOR RAISING WATER ECONOMICALLY, ESPECIALLY APPLICABLE TO ALL KINDS OF MINES, DRAINAGE, WELLS, MARINE, FIRE, &c.

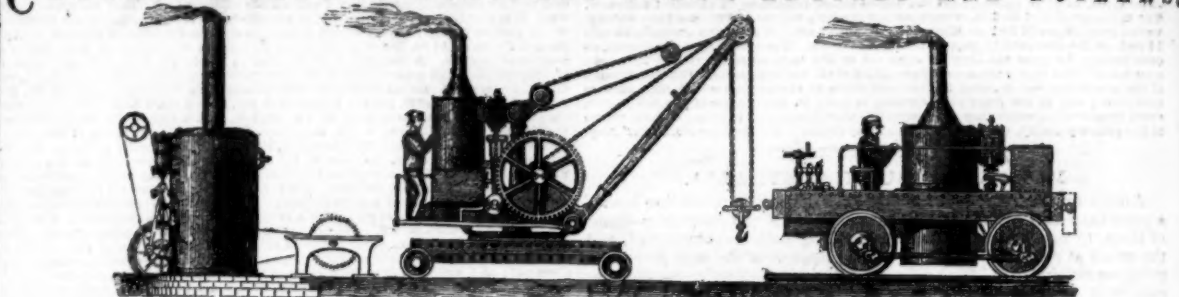
- 1.—It utilises from 90 to 92 per cent. of the motive power.
- 2.—Its price and expense of installation is 75 per cent. less than the usual pumps employed for mining purposes.
- 3.—It occupies a very small space.
- 4.—It raises water from any depth with the same facility and economy.
- 5.—It raises with the water, and without the slightest injury to the apparatus, sand, mud, wood, stone, and every object of a smaller diameter than its tube.
- 6.—It is easily removed, and requires no cleaning or attention.

A mining pump can be seen daily at work, at Wheel Concord Mine, South Sydenham, Devon, near Tavistock; and a shipping pump at Woodside Graving Dock Company (Limited), Birkenhead, near Liverpool.

J. U. BASTIER, sole manufacturer, will CONTRACT TO ERECT HIS PATENT PUMP AT HIS OWN EXPENSE, and will GUARANTEE IT FOR ONE YEAR, or will GRANT LICENSES to manufacturers, mining proprietors, and others, for the USE of his INVENTION.

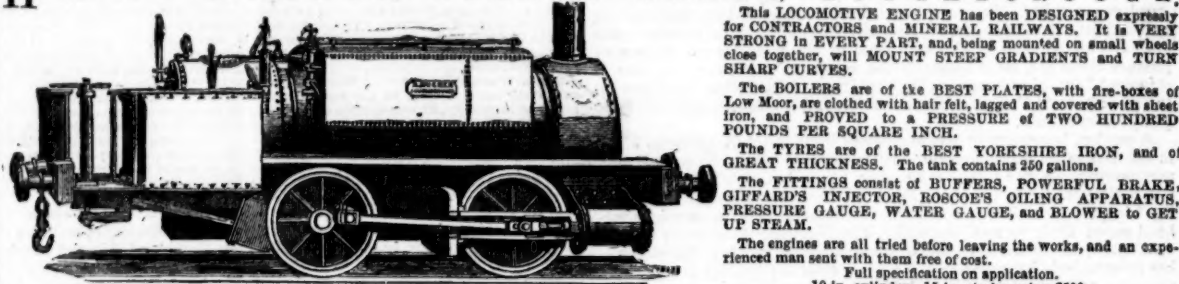
OFFICES, 63, DEAN STREET, SOHO SQUARE.
London, March 21, 1869. Hours from Ten till Four. J. U. BASTIER, C.E.

CHAPLIN'S PATENT PORTABLE STEAM ENGINES AND BOILERS.



From the STRENGTH, SIMPLICITY, and COMPACTNESS of these ENGINES, they are now extensively used for general purposes; also in situations where steam-engines of the ordinary construction cannot be applied.
STATIONARY ENGINES.—require no building in, nor chimney stack, and with our patent forced combustion apparatus will burn inferior qualities of coal, wood, or peats. These engines are specially suited for shipment, and may be packed inside the boiler, to economise freight.
PORTABLE STEAM CRANES.—for wharf or railway, with wrought-iron carriages on wheels, link motion, foot brake, &c., all under the easy control of one man; the larger sizes hoist, lower, and turn round in either direction by steam.—These Cranes were selected by H.M. Commissioners for receiving and sending away the heavy machinery at the International Exhibition of 1862.
CONTRACTORS' LOCOMOTIVES.—are adapted to work on rails or tramways, of a gauge from 2 feet upwards. They are complete and efficient locomotives, simple in construction, and the working parts easily got at for repair. They draw heavy loads at reduced speeds. These engines are usually sent in one package, ready for work on arrival.
LIGHT PORTABLE HOISTING, WINDING, AND PUMPING ENGINES, ETC.
ALEXANDER CHAPLIN AND CO., CRANSTONHILL ENGINE WORKS, GLASGOW.
LONDON OFFICE,—9, ADAM STREET, ADELPHI, W.C. LONDON DEPOT AND WHARF,—LOWER FORD STREET, LAMBETH, S.
Several engines of each class KEPT IN STOCK, for SALE OR HIRE; and all our manufactures GUARANTEED as to EFFICIENCY, MATERIAL, and WORKMANSHIP.
Parties are cautioned against using or purchasing imitations or infringements of these patent manufactures.

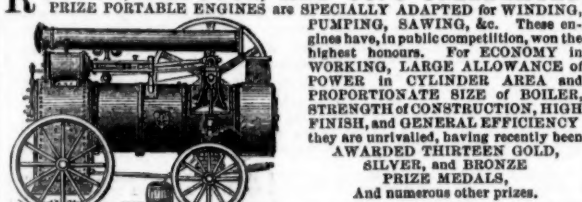
HENRY HUGHES, FALCON WORKS, LOUGHBOROUGH.



International Exhibition, 1862—Prize Medal.

JAMES RUSSELL AND SONS
(the original patentees and first makers of wrought-iron tubes), of the CROWN PATENT TUBE WORKS, WEDNESBURY, STAFFORDSHIRE, have been AWARDED A PRIZE MEDAL for the "good work" displayed in their wrought-iron tubes and fittings.
Warehouse, 81, Upper Ground-street, London, S. 1/5

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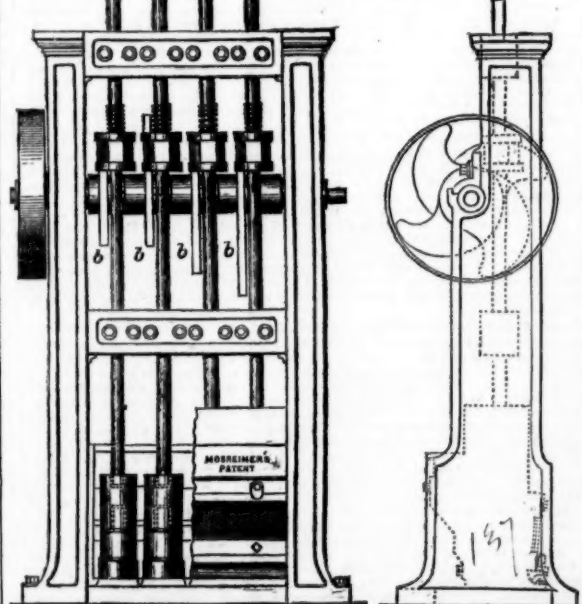


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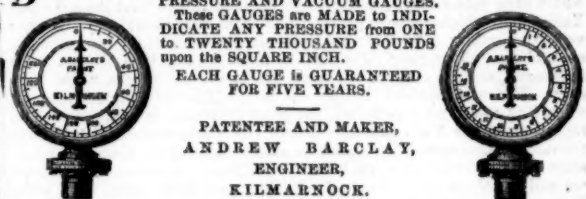
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